

# IGCSE Edexcel equations you need to be familiar with

## Section 1

Diffusion of gases: formation of ammonium chloride from ammonia and hydrogen chloride gas	$\text{HCl (g)} + \text{NH}_3\text{(g)} \longrightarrow \text{NH}_4\text{Cl (s)}$
Electrolysis of molten lead bromide	$\text{PbBr}_2\text{(l)} \longrightarrow \text{Pb (s)} + \text{Br}_2\text{(l)}$
Electrolysis of concentrated sodium chloride solution (=brine)	$2\text{H}^+\text{(aq)} + 2\text{Cl}^-\text{(aq)} \longrightarrow \text{Cl}_2\text{(g)} + \text{H}_2\text{(g)}$
Electrolysis of dilute sulphuric acid	$4\text{OH}^-\text{(aq)} + 4\text{H}^+\text{(aq)} \rightarrow \text{O}_2\text{(g)} + 2\text{H}_2\text{O (l)} + 2\text{H}_2\text{(g)}$

## Section 2

Alkali metals in water	$2\text{Na (s)} + 2\text{H}_2\text{O (g)} \longrightarrow 2\text{NaOH (aq)} + \text{H}_2\text{(g)}$ You can replace Na in the equation above with Li, K, Rb or even Cs.
Displacement of chloride ions by fluorine	$\text{F}_2\text{(aq)} + 2\text{NaCl (aq)} \rightarrow \text{Cl}_2\text{(aq)} + 2\text{NaF (aq)}$ You can replace Cl by Br or I (iodine).
Displacement of bromide ions by chlorine	$\text{Cl}_2\text{(aq)} + 2\text{NaBr (aq)} \rightarrow \text{Br}_2\text{(aq)} + 2\text{NaCl (aq)}$ You can replace Br by I (iodine).
Displacement of iodide ions by bromine	$\text{Br}_2\text{(aq)} + 2\text{NaI (aq)} \rightarrow \text{I}_2\text{(aq)} + 2\text{NaBr(aq)}$
Oxidation of copper	$2\text{Cu (s)} + \text{O}_2\text{(g)} \longrightarrow 2\text{CuO (s)}$
Laboratory preparation of oxygen using hydrogen peroxide and manganese dioxide as catalyst	$2\text{H}_2\text{O}_2\text{(l)} \rightarrow 2\text{H}_2\text{O (l)} + \text{O}_2\text{(g)}$
Burning of magnesium	$2\text{Mg (s)} + \text{O}_2\text{(g)} \rightarrow 2\text{MgO (s)}$
Burning of carbon	$\text{C (s)} + \text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(s)}$
Oxidation of sulphur	$\text{S (s)} + \text{O}_2\text{(g)} \rightarrow \text{SO}_2\text{(g)}$
Preparation of carbon dioxide using an acid and a metal carbonate	$\text{CaCO}_3\text{(s)} + 2\text{HCl (aq)} \rightarrow \text{CaCl}_2\text{(aq)} + 2\text{H}_2\text{O (l)} + \text{CO}_2\text{(g)}$
Combustion of hydrogen	$2\text{H}_2\text{(g)} + \text{O}_2\text{(g)} \rightarrow 2\text{H}_2\text{O (l)}$
Testing for water/hydration of anhydrous copper sulphate	$\text{CuSO}_4\text{(s)} + 5\text{H}_2\text{O (l)} \rightarrow \text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
Magnesium and hydrochloric acid to produce hydrogen	$\text{Mg (s)} + 2\text{HCl (aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$ Replace magnesium by any other group 2 metal or Cu or Zn
Some displacement reactions involving metals and metal salt solutions	$\text{Mg (s)} + \text{CuSO}_4\text{(aq)} \rightarrow \text{MgSO}_4\text{(aq)} + \text{Cu (s)}$ $\text{Fe (s)} + \text{CuSO}_4\text{(aq)} \rightarrow \text{FeSO}_4\text{(aq)} + \text{Cu (s)}$
Testing for sulphate ion to form a white precipitate (s) (this is also an equation for the preparation of an insoluble salt)	$\text{CuSO}_4\text{(aq)} + \text{Ba(NO}_3)_2\text{(aq)} \rightarrow \text{Cu(NO}_3)_2\text{(aq)} + \text{BaSO}_4\text{(s)}$
Testing for chloride ion to form a white precipitate (s) (this is also an equation for the preparation of an insoluble salt)	$\text{CuCl}_2\text{(aq)} + 2\text{AgNO}_3\text{(aq)} \rightarrow \text{Cu(NO}_3)_2\text{(aq)} + 2\text{AgCl (s)}$
Thermal decomposition of a metal carbonate	$\text{CuCO}_3\text{(s)} \rightarrow \text{CuO (s)} + \text{CO}_2\text{(g)}$

## Section 3

Complete combustion of methane	$\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
Incomplete combustion of methane	$2\text{CH}_4 + 3\text{O}_2 \longrightarrow 2\text{CO} + 4\text{H}_2\text{O}$
Methane reacting with chlorine in UV (substitution)	$\text{CH}_4 + \text{Cl}_2 \longrightarrow \text{CH}_3\text{Cl} + \text{HCl}$
Ethene reacting with bromine (=addition)	$\text{C}_2\text{H}_4 + \text{Br}_2 \longrightarrow \text{C}_2\text{H}_4\text{Br}_2$
Hydration of ethane to form ethanol	$\text{C}_2\text{H}_4 + \text{H}_2\text{O} \longrightarrow \text{C}_2\text{H}_5\text{OH}$
Fermentation	$\text{C}_6\text{H}_{12}\text{O}_6 (\text{aq}) \longrightarrow 2\text{C}_2\text{H}_5\text{OH} (\text{aq}) + 2\text{CO}_2 (\text{g})$

## Section 4

Acid reacting with a metal to form hydrogen and a salt	$\text{H}_2\text{SO}_4 (\text{aq}) + \text{Mg} (\text{s}) \longrightarrow \text{MgSO}_4 (\text{aq}) + \text{H}_2 (\text{g})$ Mg can be replaced by Zn, Cu or a group 2 metal
Acid reacting with a metal oxide to produce a salt and water	$2\text{HCl} (\text{aq}) + \text{MgO} (\text{s}) \longrightarrow \text{MgCl}_2 (\text{aq}) + \text{H}_2\text{O} (\text{l})$
Acid reacting with a metal hydroxide to form a salt and water	$\text{HCl} (\text{aq}) + \text{NaOH} (\text{aq}) \longrightarrow \text{NaCl} (\text{aq}) + \text{H}_2\text{O} (\text{l})$
Acid reacting with a metal carbonate to form a salt, water and carbon dioxide	$2\text{HCl} (\text{aq}) + \text{CaCO}_3 (\text{s}) \longrightarrow \text{CaCl}_2 (\text{aq}) + \text{H}_2\text{O} (\text{l}) + \text{CO}_2 (\text{g})$
Dissociation of hydrogen chloride in water	$\text{HCl} (\text{aq}) \rightarrow \text{H}^+ (\text{aq}) + \text{Cl}^- (\text{aq})$
Forming an insoluble salt e.g. lead chloride	$\text{CuCl}_2 (\text{aq}) + \text{Pb}(\text{NO}_3)_2 (\text{aq}) \rightarrow \text{Cu}(\text{NO}_3)_2 (\text{aq}) + \text{PbCl}_2 (\text{s})$
Reversible reaction dehydration and hydration of copper sulphate	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O} (\text{s}) \rightleftharpoons \text{CuSO}_4 (\text{s}) + 5\text{H}_2\text{O} (\text{l})$
Ammonium chloride reversible reaction	$\text{NH}_4\text{Cl} (\text{s}) \rightleftharpoons \text{HCl} (\text{g}) + \text{NH}_3 (\text{g})$

## Section 5

Carbon burning to make carbon dioxide; this is important because it provides the heat for the reduction.	$\text{C} (\text{s}) + \text{O}_2 (\text{g}) \longrightarrow \text{CO}_2 (\text{g})$
Carbon dioxide reacting with carbon (at the top of the furnace there is little oxygen) to form carbon monoxide	$\text{C} (\text{s}) + \text{CO}_2 (\text{g}) \longrightarrow 2\text{CO} (\text{g})$
Carbon monoxide reduces the iron oxide (this is the main reaction)	$\text{Fe}_2\text{O}_3 (\text{s}) + 3\text{CO} (\text{g}) \longrightarrow 2\text{Fe} (\text{s}) + 3\text{CO}_2 (\text{g})$
Calcium carbonate decomposing	$\text{CaCO}_3 (\text{s}) \longrightarrow \text{CaO} (\text{s}) + \text{CO}_2 (\text{g}) (\text{waste gas})$
Calcium oxide reacting with silicon dioxide to form slag	$\text{CaO} (\text{s}) + \text{SiO}_2 (\text{s}) \longrightarrow \text{CaSiO}_3 (\text{s})$
Electrolysis of molten aluminium oxide	$2\text{Al}_2\text{O}_3 \longrightarrow 4\text{Al} (\text{s}) + 3\text{O}_2 (\text{g})$
Example of cracking e.g. cracking hexane	$\text{C}_6\text{H}_{14} \longrightarrow \text{C}_6\text{H}_6 + 4\text{H}_2$
Cracking decane	$\text{C}_{10}\text{H}_{22} \longrightarrow \text{C}_5\text{H}_{12} + \text{C}_3\text{H}_6 + \text{C}_2\text{H}_4$
Haber process	$3\text{H}_2 (\text{g}) + \text{N}_2 (\text{g}) \rightleftharpoons 2\text{NH}_3 (\text{g})$
Making ammonium sulphate and ammonium nitrate (fertilizers)	$2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$ $\text{NH}_3 (\text{g}) + \text{HNO}_3 (\text{aq}) \longrightarrow \text{NH}_4\text{NO}_3 (\text{s})$
Burning of sulphur:	$\text{S} + \text{O}_2 \longrightarrow \text{SO}_2$
Roasting/burning sulphur dioxide in	$2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3$

oxygen to make sulphur trioxide	
Dissolving of the sulfur trioxide in concentrated sulphuric acid to form oleum.	$\text{SO}_3 + \text{H}_2\text{SO}_4 \longrightarrow \text{H}_2\text{S}_2\text{O}_7$
Oleum reacts with water to form sulphuric acid.	$\text{H}_2\text{S}_2\text{O}_7 + \text{H}_2\text{O} \longrightarrow 2\text{H}_2\text{SO}_4$